[Document Name] Description

[Title of the Invention] A projector and a picture projection system

[Claim(s)]

[Claim 1] A luminescence means to be the projector connected to portable data processing equipment removable, and to emit light, The projector characterized by having a deviation means to deflect the light in which said luminescence means acted as Idei, and to project a picture on a projection side, a detection means to detect the distance to said projection side, and a control means to control the deviation of the light in said deviation means by distance detected in said detection means.

[Claim 2] It is the projector according to claim 1 which said luminescence means acts as Idei of the laser light, and is characterized by said deviation means being a semiconductor resonant mirror.

[Claim 3] It is the projector according to claim 1 which has further a move detection means to detect the amount of displacement by movement of said projector, and is characterized by said control means controlling based on said detected amount of displacement.

[Claim 4] While deflecting the laser light which emits light from a luminescence means to emit light in laser light, and said luminescence means A deviation means to change the deflecting angle, to make laser light scan, and to project a picture on a projection side, The projector characterized by having a detection means to detect the distance of said luminescence means and said projection side, and a control means to control the deflecting angle of the laser light by said deviation means based on the distance detected with said detection means.

[Claim 5] By having further an output control means to control the output of laser light based on the inputted image data from the outside, and laser irradiating [by which an output is controlled by said output control means] said projection side through said deviation means The projector according to claim 4 characterized by projecting the picture based on said image data.

[Claim 6] The projector according to claim 4 characterized by having further a penetrated type image formation means to be established between said luminescence means and said projection side, and to form a picture based on said image data.

[Claim 7] A casing with the outside which can be inserted in the expansion slot of computer paraphernalia, The interface which is prepared in said casing and receives the data from said computer paraphernalia, The laser light source which emits laser light, the mirror in which the laser light outputted from said laser light source is reflected, and by deflecting the laser light which acts as Idei by said mirror from said laser light source The projection control part which projects the picture based on said data received through said interface, The projector characterized by having the primary detecting element which detects the reflected light from the projection side of the laser light which acted as Idei from said laser light source, and the control part which controls the deviation of the laser light by said mirror based on the detected reflected light.

[Claim 8] Said mirror is a projector according to claim 7 characterized by being prepared through the supporter which enables change of an angle to said casing.

[Claim 9] Are the portable projector which projects an image on the projection side concerned by projecting the laser light which acted as Idei from the light source on a projection side, and The light source of laser light, The reflector of laser light, and the actuator which changes the angle of said reflector so that the angle of reflection of laser light may be changed, The projector characterized by having the displacement primary detecting element which detects displacement of said projector, and the amendment control part which amends the degree of rotation angle of said reflector in said actuator based on the displacement detected by said displacement primary detecting element.

[Claim 10] Are the portable data processing equipment which has an expansion slot, and the projector which can be inserted in said expansion slot the picture projection system which it has, and [said portable data processing equipment] Have a processing means to process image data, and a data output means to output the image data processed with said processing means to said projector, and [said projector] The light which emitted light by luminescence means to emit light, and said luminescence means is deflected based on the image data outputted from said portable data processing equipment. The picture projection system characterized by having a deviation means to project a picture on a projection side, a detection means to detect the distance to said projection side, and a control means to control the deviation of the light in said deviation means by distance detected in said detection means.

[Claim 11] The power supply of said projector is a picture projection system according to claim 10 characterized by being supplied from said portable data processing equipment.

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the picture projection system which has a projector and a projector, and portable data processing equipment.

[0002]

[Description of the Prior Art] Although the spread of PCs (Personal Computer) is more remarkable than before, it is difficult for the display screen of PC to see the display screen of PC by two or more persons, and to mainly share information supposing a display only to a user. Then, projecting with a projector pictures, such as data created with PC, seeing the picture of data by a lot of people, and sharing information is performed at places, such as a meeting, for example. In such a case, the data of a picture is transmitted to a projector from PC, and a projector projects the picture based on the transmitted data outside.

[0003]

[Problem to be solved by the invention] However, when projecting a picture by such a technique, the cable which connects the both sides of PC and a projector at least is required, by the time it makes a picture project, these installation and connection will be needed, and there is a problem of taking time and effort. Moreover, since a certain amount of area is needed in order PC and a projector are generally heavy and to install them from it not being necessarily what thought portability as important, it cannot be said that it excels in mobility.

[0004] Moreover, personal digital assistants, such as PDA (Personal Digital Assistant) and a cellular phone, are widely used as a personal youth in recent years. Since such a personal digital assistant is small light moreover, it cannot be overemphasized that it is rich in mobility. However, although these personal digital assistants are small therefore, as compared with PC, its display screen is smaller still, and sharing of the information in two or more persons is still more difficult. Therefore, [also when using a personal digital assistant, in order to share the information in two or more persons, it is necessary to project a picture with a projector but, and] Even if the personal digital assistant side is portable, there is no change in that there is only a thing of a fixed mount type about the projector side, and it cannot declare that the composition excellent in mobility is realizable.

[0005] By the way, when projecting a picture with a projector, even and big a screen, a wall surface, etc. of thin colors, such as white, are usually required as a projection place of a picture, and when sufficient project area cannot be secured, a projector cannot be used at the

place. When it is the special use aspect [as / whose projection place is not a plane but a surface of a sphere], the pretreatment which changes a projection picture geometrically according to the form of a surface-of-a-sphere inner side beforehand is required. Moreover, a projector is installed in the side instead of the front of a projection place in many cases, in order to make it not become an obstacle of those who look at the picture on which it was projected. If a picture is projected in such the state, the picture seen from the front will be in the state where it changed into the trapezoid etc. For this reason, conventionally, a lens, PURISUMU, etc. needed to use in consideration of the form and the position of a projection side, and the projection picture needed to be adjusted. Thus, since a projector had restriction in an installation part or a projection place, this had also become the cause which spoils mobility.

[0006] Moreover, it is reasonable although such a projector is a fixed mount type from the former. That is, if a projector is made portable, modification and blur will arise in the picture on which it was the same position, and the distance and the angle from a projector to a projection place become less constant to say nothing of [continuing having a projector at the same angle] being difficult, and it was projected as a result. Thus, since it was substantially impossible to make a picture project and to transmit information correctly, carrying a projector, only the projector of the fixed mount type existed. This invention was made based on such a technical technical problem, and there is a place made into the purpose in offering the projector excellent in mobility, a picture projection system, etc.

[0007]

[Means for solving problem] It can connect with a personal digital assistant removable, and the basis of this purpose and the projector of this invention are characterized by the ability projecting the picture meant by amendment processing in projection of a picture so that it may be reflected correctly. The light emitted from a luminescence means is deflected in a deviation means in more detail, a projection side is irradiated, and a picture is made to project on a projection side by making a projection side scan light. A detection means detects the distance from a projector to a projection side in projection of this picture, and the deviation of light is controlled by a control means according to that distance. Thus, since distortion of the picture on which it is projected by changing an angle according to distance for every irradiation place, and glaring light etc. can be amended A picture is projected as portable, holding, for example

in a hand, and even if it is the case where the distance to a projection place is not kept constant, the picture reflected correctly can be projected on the eyes of those who see.

[0008] If a deviation means uses a semiconductor resonant mirror for that to which a luminescence means emits laser light again, a picture can be projected easily. However, the luminescence means may not be laser light. Moreover, a change means may not be a semiconductor resonant mirror, either, for example, a lens etc. can be used. Moreover, based on the detected amount of displacement, the deviation of light is also controllable by establishing a move detection means to detect a projector's own amount of move **** displacement (movement magnitude). For example, when holding and using a projector for a hand, the blur and modification of a picture on which it is projected by generating of blurring etc. arise. The righter picture can be projected by amending the picture on which a projector's own amount of displacement is also taken into consideration and projected.

[0009] If it asks from other viewpoints, the projector of this invention changes the deflecting angle, makes laser light scan, in what projects a picture on a projection side, will adjust the deflecting angle of laser light and will perform amendment processing while deflecting the laser light which emitted light by the luminescence means by a deviation means. Amendment processing is performed by controlling the deflecting angle of the laser light by a deviation means based on the distance which detected the distance of a luminescence means and a projection side by the detection means, and was detected with the detection means. It can use that this projector is portable for both as a fixed mount type, and the right picture can be easily projected on a projection place by amendment processing which adjusts a deflecting angle according to the distance to a projection side.

[0010] There are some methods in making a projection side scan laser light and projecting a picture. For example, based on the inputted image data, the output of laser light is controllable by output control means, such as for example, an abnormal-conditions controller, from the outside. In this case, the laser light by which the output was controlled irradiates a projection side through a deviation means, and projects the picture based on image data. Or a penetrated type image formation means to form the picture based on image data can be established between a luminescence means and a projection side, and a picture can also be projected on a projection place by making a penetrated type image formation means penetrate laser light.

[0011] This invention can also be regarded as an extended device type projector which can be used being able to insert in the expansion slot of computer paraphernalia, such as PC and a personal digital assistant. A projector is formed in a casing with the outside which can be inserted in the expansion slot of computer paraphernalia, and a casing, and it has it with the interface which receives the data from computer paraphernalia. This projector projects the picture based on the data received through the interface by making it reflect by a mirror in a projection control part, and deflecting the laser light which acted as Idei from a laser light source. And the picture on which it is projected is amended by detecting the reflected light from the projection side of laser light in a primary detecting element, and controlling the deviation of the laser light by a mirror by a control part based on the detected reflected light. In this projector, if the mirror is prepared through the supporter which enables change of an angle to a casing, the projection direction of a picture can be chosen freely.

[0012] Furthermore, if this invention is grasped from other viewpoints, you may be the portable projector which detects displacement of a projector and performs amendment processing based on the detected displacement. In making it reflect by a reflected light and laser irradiating [which acted as Idei from the light source] a projection side in detail, an image is projected on a projection side by laser irradiating a projection side, changing the angle of a reflector by an actuator. At this time, the blur of a picture and the amendment of modification on which it is projected by generating of blurring etc. can be performed by detecting displacement in a displacement primary detecting element, and amending the degree of rotation angle of the reflector in an actuator in an amendment control part based on the detected displacement.

[0013] Moreover, if this invention is grasped in other viewpoints, it can also regard as a picture projection system equipped with the portable data processing equipment which has an expansion slot, and the projector which can be inserted in an expansion slot. With portable data processing equipment, the image data which you want to display by a processing means is processed, and, specifically, the processed image data is outputted to a projector from a data output means. On the other hand, with a projector, the light emitted based on image data is deflected, and a picture is projected on a projection side. And the deviation of light is controlled according to the distance to a projection side, and amendment processing is performed. In this system, a projector can insert in a portable expansion slot and can use a

projector if needed. In this case, it is possible to supply the power supply of a projector from portable data processing equipment. With constituting in this way, it is smaller and the projector itself can be made lightweight.

[0014]

[Mode for carrying out the invention] Based on the form of operation shown in an accompanying drawing, this invention is explained in detail hereafter. [Form of the 1st operation] Drawing 1 is a block diagram for explaining the whole projector composition in the picture projection system in the form of this operation. Drawing 2 is an outline view for explaining the projector shown in drawing 1. Drawing 3 is a partial enlarged plan view for explaining the basic structure of a semiconductor resonant mirror part prepared in the projector shown in drawing 1. Drawing 4 is a side view for explaining the busy condition of the picture projection system which inserted in the expansion slot of PDA as portable data processing equipment the projector shown in drawing 1.

[0015] As shown in drawing 1, [the portable projector 10 (henceforth a projector 10)] the control part (a control means --) which controls the output of laser light, the angle of a mirror, etc. [displacement of the mirror actuator 110 which rotates the projection control part 101, the light source (luminescence means) 109 of a semiconductor laser, the mirror (reflector) 111 that reflects and deflects laser light, and a mirror 111, the light sensing portion 115 which detects the reflected light from a projection side (wall surface w), and a projector 10] It has the displacement primary detecting element 116 to detect and the interface part 120 which receives image data from the expansion slot bus 150 of PDA50, and is constituted.

[0016] [the control part 101] [rotation of a mirror 111] [reflector / the mirror control part 103 to control, the laser control part (abnormal-conditions controller) 104 which controls the output of laser light, and / with the distance calculation part 105 which computes distance with a projection side, the amount calculation part 106 of displacement which computes the amount of displacement of projector 10 self, and the distance and displacement which were computed] It has the amendment data calculation part 107 which computes the data which should be amended.

[0017] As a projector 10 which has the above composition, as shown, for example in drawing 2, the supporter 13 which connects possible [rotation of a casing 11, the semiconductor resonant mirror part 12, and a casing 11 and the semiconductor resonant mirror part 12] is included. A casing 11 builds in the control part 101, the light source 109 of a semiconductor laser, the light sensing portion 115, and the displacement primary detecting element 116 which were shown by drawing 1, further, makes it expose to the peripheral face, and has the interface part 120. The semiconductor resonant mirror part 12 has the mirror actuator 110 of a mirror 111 and a mirror 111.

[0018] A supporter 13 is equipping the inside with a cavernous part (not shown), for example, and is made possible [leading the laser light discharged from the casing 11 to the semiconductor resonant mirror part 12]. Moreover, as long as 360-degree rotation is possible and the semiconductor resonant mirror part 12 is allowed also to the direction of an axis along with the circumference of an axis so that various angles can be taken to a casing 11, the supporter 13 is constituted so that rotation may become possible. If it has such composition, a picture can be projected in the arbitrary directions. In addition, although this supporter 13 can change an angle with manual operation, it may change an angle with the control signal sent out from the control part 101.

[0019] In the semiconductor resonant mirror part 12, as shown in drawing 3, the mirror 111 is held possible [the rotation to the direction of an arrow] with the support axes 112a and 112b at the support frame 112. Furthermore, the support frame 112 is held possible [the rotation to the direction of an arrow] with the support axes 113a and 113b at the support frame 113. The support axes 112a, 112b, 113a, and 113b rotate by the mirror actuator 110 prepared in the semiconductor resonant mirror part 12. As a result, the semiconductor resonant mirror part 12 is made possible, it deflects the laser light reflected and that it is also suitable in the arbitrary directions can irradiate the target part now. By using such a semiconductor resonant mirror part 12 as a reflector of laser light, a projector 10 can be made [convenient to carry / small] lightweight. Moreover, the light sensing portion 115 is formed in this semiconductor resonant mirror part 12. In addition, although it is desirable to prepare near the semiconductor resonant mirror part 12 as for a light sensing portion 115, it can also prepare in other portions.

[0020] A projector 10 is used in the state where it was inserted into the expansion slot 51 of

PDA50 as a casing 11 showed drawing 4. PDA50 can store a projector 10. It has the image data output part 151 which outputs the data outputted from the expansion slot 51 with the expansion slot bus 150 (refer to drawing 1) shown in drawing 1, the processing part 152 of the image data of the picture which should be displayed, and the processing part 152 to a projector 10, and is constituted. Moreover, the expansion slot 51 is equipped with an electric power supply means to supply electric power to a projector 10.

[0021] At the time of the picture projection using the picture projection system which consists of a projector 10 and PDA50, as shown in drawing 4, the supporter 13 of a projector 10 is rotated so that the mirror 111 of 12 copies of semiconductor resonant mirrors may meet mostly to a projection place. And image data is transmitted to a projector 10 through the interface part 120 from PDA50, and laser light is irradiated from a projector 10 at a projection place so that the image data may be projected. At this time, laser light is projected on a picture by the projection place by deviating in the direction of two dimensions in the semiconductor resonant mirror part 12 of a projector 10.

[0022] [thus, the thing for which the removable projector 10 is inserted and used for PDA50 as shown in drawing 4] Usually, the special function as a projector 10 can be given to PDA50 used as a personal digital assistant, and if such a picture projection system is used, even if the display screen of portable data processing equipment is small, sharing of the information in two or more persons can carry out easily. That what is necessary is to use it only at the time of necessity, since a projector 10 is small and lightweight, the projector 10 can make it convenient to carry. The power supply used as the source of a drive of a projector 10 is not prepared in a projector 10, but since it constitutes so that it may supply from the outside (PDA50), a projector 10 can be made small and lightweight. However, the power supply which makes a projector 10 drive is not supplied from PDA50, but may have a power supply in a projector 10.

[0023] Next, details are explained about the projection method of a picture. Drawing 5 is the explanatory view showing the right picture (picture without modification or distortion) on which it was projected with the projector 10 shown in drawing 1. When projecting a picture 70 on the range of the shape of a rectangle as shown in drawing 5, it is scanning in the main scanning direction (x direction) by glaring laser light, changing a mirror angle one by one. That is, in the top sequence L1, it is laser light to a x direction C1, C2, and C3 -- It is made to glare to Cn.

Next, in the sequence L2 of the bottom in the subscanning direction (y direction), it is C1, C2, and C3 to a x direction similarly. -- It is made to glare to Cn. The irradiation to such a x direction is repeated to the bottom sequence Lm, and is performed. After irradiation of laser light reaches to the last sequence Cn of the x direction of the last sequence Lm of a y direction, again, from the first line C1 of the x direction of the sequence L1 of the top of a y direction, said irradiation processing in which irradiation is continued similarly is repeated continuously, and is performed. At this time, irradiation of the laser light irradiated to each coordinates (C, L) is controlled.

[0024] Control of irradiation of the laser light in each coordinates is performed as follows. First, image data is sent out through the interface part 120 of a projector 10 to the control part 101 from PDA50. This image data contains coordinate data and the data (for example, brightness, luminosity, a color tone, on--off, etc.) in which the kind of laser light in those coordinates is shown. And the data in which the kind of laser light is shown is sent out to the laser control part 104 which controls the light source 109 of a semiconductor laser. Moreover, the data in which coordinates are shown is sent out to the mirror control part 103 which controls the mirror actuator 110 of a mirror 111.

[0025] In the laser control part 104, laser light is modulated according to the data in which the kind of light is shown. Specifically based on the sent-out data, the intensity abnormal conditions in laser light generating of the light source 109 of a semiconductor laser are controlled by the laser control part 104 of the control part 101 (light-and-darkness adjustment, on--off, etc.). If such a laser control part 104 is used, projection of the laser light for every projecting point is easily controllable. Moreover, when using two or more sorts of laser lights as a laser light, it is possible to also perform control about selection of the kind of laser light. With the form of this operation, since the semiconductor laser is used as laser, it can be small, and can dedicate in the casing 11 of a projector 10, the size of a projector 10 can be made small, and weight can also be made light. However, it is also possible for laser not to be restricted to a semiconductor laser and to use lights other than laser.

[0026] On the other hand in the mirror control part 103, a mirror 111 is driven based on the data in which coordinates are shown. Specifically based on the sent-out data, the mirror actuator 110 which drives a mirror 111 is controlled by the mirror control part 103 of the control part 101. At this time, a mirror 111 is rotated by the target angle by control of the mirror

actuator 110. The target angle is set up so that the coordinates which the laser light reflected by a mirror 111 makes the purpose of the wall surface w which is a projection place may glare. In addition, the drive of a mirror 111 is controlled also by amendment processing mentioned later.

[0027] Thus, it becomes irregular and the outputted laser is irradiated toward the mirror 111 set as the target angle in the mirror control part 103. As a result, laser is reflected and deflected by a mirror 111 and is irradiated by the coordinates made into the target on the wall surface w of drawing 1. Although irradiation of such a laser light is performed one by one in each coordinates of the picture 70 of drawing 5, a picture 70 comes to be recognized as a result of regarding vision as an afterimage in the reflected light of the laser light in each coordinates, since irradiation processing of laser light is performed at high speed and continuously. In addition, the direction of radiation and irradiation order of laser light may perform processing it is not restricted to the above-mentioned method, for example, irradiate a y direction continuously one by one to a x direction.

[0028] Next, an example is given and explained about amendment processing of a picture. Drawing 6 is an upper surface figure explaining an example when modification arises in projection of a picture. Drawing 7 is a front view explaining the projected picture, and the front view of the picture 71 which does not perform amendment processing projected in the state which showed drawing 7 (a) in drawing 6, and drawing 7 (b) are the front views showing the picture 72 of the imagination in the virtual wall surface wo after amendment processing. If the distance d from the projector 10 as shown in drawing 6 to the wall surface w which is a projection place changes with directions of radiation of laser light, as shown in drawing 7 (a), modification will arise in a projection picture. For example, a spectator is located in the front of a projection side at the time of projection of a picture, and a picture is projected from the side of a projection side in many cases so that those who hold in a hand PDA50 to which the projector 10 was connected, and project a picture may not interrupt a spectator's field of view. Such a situation is similarly produced, even if it is the case where it is used fixing without holding in a hand PDA50 to which the projector 10 was connected. Furthermore, when it holds in a hand and a picture is projected, the direction of radiation may produce also by changing with blurring. Thus, there is a situation of projecting a picture from across, plentifully.

[0029] In such a case, the picture 71 on which it is projected when performing no amendment

serves as form which changed into the trapezoid as shown in drawing 7 (a). The picture on which it was projected becomes large, so that the distance from a projector 10 to a projection place is long, since the laser light irradiated from a projector 10 is scanned changing an irradiation angle by a mirror 111. If the sequence L1 of the picture 71 in drawing 7 (a) is explained concretely As shown in drawing 6, the distance d1 from a projector 10 to the coordinates (C1, L1) of the picture 71 on a wall surface w is the shortest, and the distance dn from a projector 10 to coordinates (Cn, L1) is the longest to it. In this case, the interval of sequence C which adjoin each other toward coordinates (Cn, L1) from coordinates (C1, L1) as shown in drawing 7 (a) is becoming large gradually. Moreover, similarly, the interval of adjacent line L is also large as it goes to Sequence Cn from a sequence C1. It amends along with a flow which explains the picture 71 of such projection that changed below.

[0030] Drawing 8 shows the flow of amendment processing of the irradiation place of the laser light in the projector 10 shown in drawing 1. In Step S201, laser light is first glared for projection of a picture. The irradiated laser light is reflected in the wall surface w which is a projection place. At Step S202, the reflected reflected light is detected in the light sensing portion 115 of a projector 10. The detection means in particular of the reflected light in a light sensing portion 115 is not limited. For example, random granular signs that it is called the speckle pattern (Speckle Pattern) observed by glaring laser light are also detectable with a detection means. With the dynamic speckle pattern which can detect various phenomena, for example, is changed at random in time, the following phenomena are detected by observing this speckle pattern. - If the object which glared laser light moves, a speckle pattern will carry out parallel translation with movement. - If laser light is glared under the same conditions, the same speckle pattern will reappear. A peculiar speckle pattern appears corresponding to the object surface where laser light is irradiated. - If the object with which laser light is irradiated approaches the irradiation side, the area of a speckle pattern will change proportionally. Such a phenomenon is caught in the above-mentioned detection means by optical detection means, such as CCD (Charge Coupled Device) as a light sensing portion 115, and APD (Avalanche Photo Diode).

[0031] The light-receiving data detected as mentioned above is sent out to the control part 101. At Step S203, the distance from the projector 10 to the wall surface w which is a projection place is computed based on the detected data. The time taken until it reflected on the wall surface w, even the projector 10 arrived and the discharged laser light was specifically detected by the light sensing portion 115 is computed in the distance calculation part 105 of

the control part 101. And the distance from the mirror 111 to the wall surface w which is a projection side is further computed from the speed of the computed time and laser light.

[0032] At the following step S204, amendment data is computed based on the distance computed in Step S203. Calculation of amendment data is performed by comparing the distance used as a fiducial point with the computed distance. When a difference is between the distance and the fiducial point which were computed, amendment data is computed in the following step S204. When there is no difference, it is not necessary to perform more than this and amendment processing. In Step S204 which computes amendment data, the distance dstandard used as a fiducial point can be set up arbitrarily. For example, when shown in drawing 7 (a), distance from the projector 10 at the time of assuming that a wall surface is in the position of the distance d1 shown in drawing 6, namely, projecting a picture on the virtual wall surface w0 to the virtual wall surface w0 is made into the distance dstandard used as a fiducial point. And when distance of a between [wall surfaces w] is actually set to dn, it turns out that it is necessary to amend by the distance ddiff of (dn-dstandard). Specifically since the distance between the adjacent coordinates in irradiation of a part with a far distance from a projector 10 and laser light (between spacing and a sequence) has spread The spreading quantity is calculated, and the amendment data for changing the irradiation angle of laser light based on the obtained data is computed so that between the part spacing and a sequence may become narrow. By such amendment processing, the picture on which it is projected on the virtual wall surface w0 turns into the picture 72 of imagination as shown in drawing 7 (b).

[0033] In addition, relative movement with a projector 10 and a projection place (the wall surface w in this case) is simultaneously [not only with distance but distance] detectable by detecting the speckle pattern in the reflected light of said laser light. Thus, it is also possible to compute amendment data based on the data based on the movement magnitude and the move direction which were detected. Moreover, a fine vibration produced when it projects, where a projector 10 is held in a hand is detectable. It is also possible to detect displacement of such hand deflection etc. and to compute amendment data according to the detected amount of displacement.

[0034] The computed amendment data is sent out to the mirror control part 103 in the control part 101. Then, based on amendment data, by control of the mirror control part 103, the mirror actuator 110 drives and an angle change of a mirror 111 is made (Step S205). Thus, although

the mirror actuator 110 of a mirror 111 is controlled by the mirror control part 103 with the data to which it is indicated that the coordinates in image data described above, this control is performed by considering such amendment processing.

[0035] Irradiation of the laser light to the x direction and y direction in the picture 70 shown in drawing 5 ends briefly, and amendment processing as shown in drawing 8 can be performed when glaring to a x direction and a y direction again. At the time of irradiation of a first-time laser light, amendment to distance is not performed at all, i.e., as it glares on the virtual wall surface w0 in drawing 7 (a), it carries out. And the distance from a projector 10 to an irradiation place is measured at the time of first-time irradiation, and the amendment data calculation part 107 of the control part 101 in a projector 10 is made to memorize. At the time of irradiation of a laser light for the second time, amendment data is computed from the distance to the projection place measured at the time of irradiation of the laser light of the memorized first time, and amendment processing is performed.

[0036] However, you may use the detected distance data for amendment processing of irradiation of the laser light irradiate the coordinates which follow the next of the coordinates by which the distance data was computed. In this case, the distance data used for amendment differs from an exact distance about the coordinates which glare laser light. However, since the coordinates which computed distance data, and the coordinates which glare the laser light to amend are in a mutual very near position, its error of the distance is small. It is clear when especially a projection place is a continuation side. Thus, if amendment processing is carried out, time until amendment is reflected will be short, and the distance amount of data which the amendment data calculation part 107 is made to memorize will also have it, and it will end.
[little]

[0037] In the flow which glares laser light as mentioned above and projects a picture, the above amendment processings are performed and the irradiation angle of the laser light irradiated is changed. As a result, the picture 71 which changed as shown in drawing 7 (a) can be amended in the picture 70 as shown in drawing 5. Since the distance from the projector 10 used for amendment processing at this time to a wall surface w is detected at the velocity of light, it can amend a picture temporally, without almost producing a time lag. As a result, the spectator of a projection picture can see the amended right picture. As a spectator's field of view is not interrupted in particular, even if it is the case where a picture is projected using a

projector 10 from the side of a projection side, a picture can be amended simply and automatically and it is very convenient. Even if it does not hold this projector 10 in a hand, but it installs it to somewhere and it uses it as a projector of a fixed mount type, it can acquire the same effect.

[0038] Amendment of modification of the projection picture by the difference in the distance from such a projector 10 to a projection place is not restricted to the thing of the state which shows in drawing 6 and drawing 7. For example, as shown in drawing 9, when it applies to a wall surface w from Ceiling r and a picture is projected, if it does not amend at all, the picture in Ceiling r will change into a trapezoid bordering on the boundary line of Ceiling r and a wall surface w like the picture 73 shown in drawing 10. Also in this case, it can amend by performing the above-mentioned amendment processing in the picture 70 as shows drawing 5 the picture 73 which changed as shown in drawing 10. Thus, since the irradiation angle of laser light can be changed based on the distance to an irradiation place even if it is what kind of projection side, for example, the field which has unevenness, if a projector 10 is used, the right picture can be projected. Furthermore, even if a curtain etc. is the case where the field that unevenness changes irregularly temporally is made into a projection side, since a projection picture is amended immediately temporally, the projector 10 can project the right picture.

[0039] Furthermore, the projector 10 can also have the displacement primary detecting element 116. The displacement primary detecting element 116 is a displacement detection means which consists of angular velocity sensors, such as a piezo-electric oscillating gyroscope, for example. If displacement of the projector 10 which considered hand deflection etc. as the cause arises when PDA50 which inserted the projector 10 are held by hand, blur will arise also in the picture on which it is naturally projected. Thus, when a projector 10 moves and displacement arises, it is desirable to detect the displacement to level and a perpendicular direction in the displacement primary detecting element 116, and to perform amendment processing as follows with the amount of displacement.

[0040] Drawing 11 is the figure showing the flow of the amendment processing based on displacement. At Step S301, displacement of projector 10 self is detected in the displacement primary detecting element 116. The detected displacement is compared with a fiducial point in the amount calculation part 106 of displacement of the control part 101 by Step S302. When it

is beyond a fiducial point as compared with a fiducial point, amendment data is computed in Step S303. Thus, amendment processing is performed only about displacement by vibration which is not meant [deflection / hand], and amendment processing can be prevented from working by establishing a fiducial point and performing amendment processing to the displacement which meant the turn of the irradiation place. When the amount of displacement is below a fiducial point, the amendment processing by displacement is ended. In addition, a fiducial point can be set up to judge it as hand deflection when it is vibration of about 20Hz or less, for example.

[0041] Furthermore, in Step S304, the computed amendment data is sent out to the mirror control part 103. The drive of the mirror actuator 110 of a mirror 111 is controlled by Step S305 by the mirror control part 103. And the angle of a mirror 111 is changed in Step S306. therefore, [amendment processing in the form of this operation] Amendment processing based on the amount of displacement by distance data, hand deflection, etc. to a wall surface w is performed, and the mirror actuator 110 of a mirror 111 is controlled by the mirror control part 103 with the data in which the coordinates in the above mentioned image data are shown, distance data, and the amendment data based on the amount of displacement.

[0042] By the picture projection system equipped with a projector 10 and PDA50 as stated above, the information on PDA50 is sharable by two or more persons. And the right picture can be projected by amendment processing also to what does not choose the projection place of a picture, for example, has not only an even field but unevenness, the thing which has a curved surface, and the thing which is easy to move like a curtain. Moreover, neither the installation position of a projector 10 nor an installation state is limited. For example, however it may install projecting on a lower part from the upper part projected from across etc., it can glare to the irradiation place made into the purpose by adjustment of a supporter 13, and amendment processing is carried out by adjustment of a semiconductor resonant mirror, and the right picture can be projected. It is also possible to install on a stand etc. and to use it like a fixed mount type projector as well as using it, holding a projector 10 in a hand etc.

[0043] In addition, in the form of implementation of the above 1st, before displaying a picture, the light which is not visible to people's eyes may be glared to a x direction and a y direction, the distance to a projection place may be measured about each coordinates, and amendment processing may be performed from the projection time of a first-time picture based on the

measurement result. Furthermore, although it may go only at the time of irradiation of a first-time laser light, this amendment processing may be performed for every predetermined time or number of times of predetermined irradiation, and may measure distance in irradiation of all the laser lights continuously, and may perform amendment processing. Furthermore, when it thinks that the user of a projector 10 is required, directions of amendment processing are given through PDA50, and amendment processing may be made to be performed only when there are directions of amendment processing.

[0044] Moreover, in the form of this operation, have the displacement primary detecting element 116 and the projector 10 may not be. Furthermore, it sets as a form of other operations in this invention to the picture projection system which consists of a projector 10 and PDA50. Amendment processing of the picture by distance is not performed, without forming a light sensing portion 115 and the distance calculation part 105, but it has the displacement primary detecting element 116, and detection of the amount of displacement may perform amendment processing of a picture.

[0045] [Form of the 2nd operation] Drawing 12 is a block diagram for explaining the portable projector whole composition of the picture projection system in the form of the 2nd operation. Although the picture was projected by modulating laser light for every coordinates with the form of the 1st operation, it is characterized by projecting a picture by making a liquid crystal penetration board penetrate laser with the form of the 2nd operation. In addition, about the same composition as the form of the 1st operation, it explains using the same mark and the detailed explanation is omitted here.

[0046] As shown in drawing 4 like the projector 10 shown in drawing 1, the portable projector 10a (henceforth Projector 10a) shown in drawing 12 is inserted into the expansion slot 51 of PDA50, and constitutes a picture projection system. However, Projector 10a is further equipped with the liquid crystal actuator 130 which makes the liquid crystal of the penetrated type liquid crystal display panel (penetrated type image formation means) 131 and the liquid crystal display panel 131 drive, the liquid crystal display panel actuator 134 to which the position of the liquid crystal display panel 131 is moved, and the lens 132. It differs from the projector 10 shown in drawing 1 with the point which is not equipped with the displacement primary detecting element 116. Moreover, it differs from the projector 10 shown in drawing 1 with the point which consists of control parts 101a of Projector 10a by having the liquid crystal

drive control part 133 and the liquid crystal display panel drive control part 135.

[0047] Projector 10a has the penetrated type liquid crystal display panel 131 in the direction of radiation of laser light reflected by the mirror 111, and has a lens 132 further at the point. The liquid crystal display panel 131 has the composition which sandwiched the liquid crystal, for example by two deviation panels. The liquid crystal display panel 131 has two or more optical penetration parts, and forms a liquid crystal picture in the liquid crystal display panel 131 by adjusting each degree of optical penetration. This liquid crystal picture may be colored a color by adjusting for example, a deviation panel. A change of the degree of penetration of the light in each optical penetration part is made by the drive of the liquid crystal by the liquid crystal actuator 130. On the other hand, the liquid crystal display panel actuator 134 is a means by which the distance from the mirror 111 to the liquid crystal display panel 131 is changeable, by adjusting the position of the liquid crystal display panel 131. For example, when the liquid crystal display panel 131 is a quadrangle, it is desirable that movement of each corner to order is mutually enabled independently, and the distance from a mirror 111 to each optical penetration part of the liquid crystal display panel 131 can set up now arbitrarily. In addition, the lens 132 can expand the picture on which it is projected, and is a convex lens.

[0048] The flow of the picture projection using Projector 10a is performed like the flow in the form of the 1st operation. However, control of the liquid crystal [in / at the form of the 2nd operation / in the abnormal conditions of laser light / the liquid crystal display panel 131] using Projector 10a is performed, and adjustment of the position of the liquid crystal display panel 131 is performed with the drive of a mirror 111.

[0049] Based on image data, the abnormal conditions of laser light are first performed like the form of the 1st operation. Furthermore, based on image data, the liquid crystal drive control part 133 controls the liquid crystal actuator 130. At this time, a liquid crystal drives for every optical penetration part according to the data in which the kind of the coordinate data which image data has, and light is shown. As a result, the picture based on image data is formed in the liquid crystal display panel 131.

[0050] In order to make the picture formed in the liquid crystal display panel 131 as mentioned above on the other hand penetrate laser light, it rotates so that a mirror 111 may drive based

on image data like the form of the 1st operation and a mirror 111 may serve as a predetermined angle. At this time, regulation of the degree of rotation angle is performed based on the detected amendment data. With the form of the 2nd operation, adjustment of the position of the liquid crystal display panel 131 is performed with angle change of the mirror 111 by this amendment processing. Specifically, the liquid crystal display panel actuator 134 drives by the liquid crystal display panel drive control part 135. This drive adjusts the position of each vertex (the case of the square liquid crystal display panel 131 four vertices) of the liquid crystal display panel 131, and changes the angle of the liquid crystal display panel 131 to a mirror 111. As a result, the distance from each optical penetration part of the liquid crystal display panel 131 to a mirror 111 is adjusted. Even if the direction of radiation of laser light reflected by angle change of the mirror 111 in Step S203 changes, the optical penetration part made into the target which should be penetrated can be made to penetrate laser light certainly, if constituted in this way.

[0051] Thus, it is reflected in a predetermined angle by the mirror 111, and the laser light which penetrated the liquid crystal display panel 131 is irradiated by the wall surface w of a projection place in the state where it deviated by penetrating a lens 132. The picture formed in the liquid crystal display panel 131 can be projected on a wall surface w by making irradiation of this laser light scan in the direction of two dimensions, and glaring to each coordinates. Since amendment by the difference in the distance to a projection place is performed at this time, the right picture can be projected. Thus, when a picture is projected using the projector 10a of the form of the 2nd operation, like the form of the 1st operation, the modification of a projection picture and distortion by the difference in the distance to a projection place or change of distance can be amended, and the right picture can be projected.

[0052] With the form of the 2nd operation, by forming a lens 132, a picture can be expanded efficiently and can be projected. In addition, when the angle of a mirror 111 which can be rotated is large (i.e., when the range of laser light which can be glared is large), the size of the picture on which it is projected by adjusting the angle of a mirror 111 can be enlarged. In such a case, Projector 10a may not have a lens 132.

[0053] Moreover, in the form of this operation, Projector 10a is not equipped with the abnormal-conditions controller which controls the light source 109 of a semiconductor laser, but the laser light irradiated may be adjusted by only the processing which penetrates the

liquid crystal display panel 131.

[0054] Moreover, in Projector 10a, the liquid crystal display panel 131 may have one optical penetration part. In this case, the liquid crystal display panel 131 will bear the same function as the laser control part 104 which adjusts the output of the laser light in the form of the 1st operation. In this case, the liquid crystal display panel 131 does not need to be formed between a mirror 111 and the wall surface w which is the projection place of a picture, for example, may be prepared between the light source 109 of a semiconductor laser, and a mirror 111.

[0055] Furthermore, Projector 10a may have the displacement primary detecting element 116 with which the projector 10 is equipped. In this case, the control part 101a has the amount calculation part 106 of displacement, and can perform amendment processing which considered the amount of displacement at the time of mirror control.

[0056] In addition, a projector is not connected with other computer paraphernalia as a form of operation of this invention, but the projector itself may have the processing part of image data, and the storing part of image data. In this case, since the image data projected into a projector can be processed, even if it does not use with other data processing equipments, such as portable data processing equipment, the projector itself can be used alone and a picture can be displayed. It is not necessary to prepare the display for displaying a picture on the projector itself which has such composition, and can suppress that the capacity and weight of a projector become large.

[0057]

[Effect of the Invention] As explained above, according to this invention, a projector and a picture projection system excellent in mobility can be obtained.

[Brief Description of the Drawings]

[Drawing 1] It is a block diagram for explaining the whole extended device type projector composition of the picture projection system in the form of this operation.

[Drawing 2] It is an outline view for explaining the extended device type projector shown in drawing 1.

[Drawing 3] It is a partial enlarged plan view for explaining the basic structure of the semiconductor resonant mirror part of the projector shown in drawing 1.

[Drawing 4] It is a side view for explaining the busy condition of the picture projection system which inserted the projector shown in drawing 1 into PDA as portable data processing equipment.

[Drawing 5] It is the explanatory view showing the right picture on which it was projected with the projector shown in drawing 1.

[Drawing 6] It is an upper surface figure explaining an example when modification arises in projection of a picture.

[Drawing 7] The front view of the picture projected in the state which showed (a) in drawing 6, and (b) are the front views of the picture in the virtual wall surface after amendment.

[Drawing 8] The flow of amendment processing of the irradiation place of the laser light in the projector shown in drawing 1 is shown.

[Drawing 9] It is a side view explaining an example when modification arises in projection of a picture.

[Drawing 10] It is the front view of the picture projected in the state which showed in drawing 9.

[Drawing 11] The flow of the amendment processing based on displacement is shown.

[Drawing 12] It is a block diagram for explaining the portable projector whole composition of the picture projection system in the form of the 2nd operation.

[Explanations of letters or numerals] 10 10a -- A projector, 11 -- A casing, 12 -- Semiconductor resonant mirror part (deviation means), 13 -- A supporter, 50 -- PDA (computer paraphernalia, portable data processing equipment), 51 -- An expansion slot, 101 -- A control part (a control means, projection control part), 103 -- Mirror control part, 104 -- A laser control part, 105 -- A distance calculation part, 106 -- The amount calculation part of displacement, 107 -- An amendment data calculation part, 109 -- The light source of a semiconductor laser (luminescence means), 110 -- A mirror actuator, 111 -- A mirror (reflector), 115 -- Light sensing portion (primary detecting element), 116 -- A displacement primary detecting element (move detection means), 120 -- Interface part, 150 [-- A liquid crystal display panel (penetrated type image formation means), 132 / -- A lens, 133 / -- A liquid crystal drive control part, 134 / -- A liquid crystal display panel actuator, 135 / -- Liquid crystal display panel drive control part] -- An expansion slot bus, w -- A wall surface, 130 -- A liquid crystal actuator, 131

[Translation done.]